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RESEARCH ARTICLE

New records of geometrid moths of the subfamily Ennominae (Lepidoptera: Geometridae) from the Amurskaya Oblast, Russian Far East

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Abstract

Eleven species of geometrid moths from the subfamily Ennominae (Lepidoptera: Geometridae) are reported for the first time from Amurskaya Oblast at the extreme northwestern limit of the distribution of mixed broadleaved – Korean pine (*Pinus koraiensis*) forests, at a great distance from their closest habitats in Khabarovsky Krai and Primorsky Krai, Russian Far East: *Eilicrinia nuptaria* Bremer, 1864, *Eudjakonovia emundata* (Christoph, 1881), *Menophra senilis* (Butler, 1878), *Ectropis excellens* (Butler, 1884), *Ectropis aigneri* Prout, 1930, *Mesastrape fulguraria* (Walker, 1860), *Arichanna tetrica* (Butler, 1878), *Agriopis dira* (Butler, 1878), *Larerannis orthogrammaria* (Wehrli, 1927), *Phigalia verecundaria* (Leech, 1897), and *Phanerothyris sinearia* (Guenée, 1858).

Keywords

Palaearctic, biodiversity, new record, border of the Euro-Siberian and East Asian zoogeographic subregions, mixed broadleaved Korean pine forests

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Introduction

Amurskaya Oblast of Russia is located in eastern Asia on the border of the Euro-Siberian and East Asian zoogeographic subregions of the Palaearctic, which determines the mixed nature and richness of its fauna, including geometrid moths. The species composition of geometrids in this area was studied in the second half of the 19th century (Graeser, 1889; Hedemann, 1879, 1881), and at the beginning of the 21st century, 283 species became known from it (Mironov et al., 2008). Subsequently, because of the activation and expansion of the research area, the known species richness of the moths grew rapidly. In the Annotated Catalogue of Insects of the Russian Far East, 361 species are given for the territory of the Amurskaya Oblast (Beljaev, 2016). The next year, 27 species were added (Kuzmin, Beljaev, 2017). Two more species of geometrids were added in the second edition of the Catalogue of Lepidoptera of Russia (Beljaev, Mironov, 2019). Thus, to date, 390 species of Geometridae have been recorded in the literature from the Amurskaya Oblast. Nevertheless, this territory remains unevenly explored. In particular, the moth fauna remained poorly studied in the southeast of the region, where the northwestern border of the distribution of mixed broadleaved – Korean pine (*Pinus koraiensis*) forests lay. Studies carried out in 2019-2021 in this region added 11 more species to the composition of geometrid moths in the Amurskaya Oblast, the publication of which is the purpose of this work.

Material and methods

The collection of moths was carried out in 2019–2021 at the following points in the southeast of the Amurskaya Oblast (Fig. 1). The moths collected at night by attracting on the light 125 W mercury lamp, powered by a portable electric generator. The specimens are kept in the private collection of the first author. Latin names, the order of genera, and the number of species by region are given under the Catalogue of Lepidoptera of Russia (Beljaev, Mironov, 2019), the order of species in genera and distribution, added by Amurskaya Oblast, – according to the Annotated catalogue of insects of Russian Far East (Beljaev, 2016). The distribution "Khabarovsky Krai" is given, including the small Jewish Autonomous Oblast.

Results

Eilicrinia nuptaria Bremer, 1864
Fig. 2.

Material examined. 2 ♀♀, Arkharinsky District, Khingan Nature Reserve, Karapcha cordon, 2 km west of Kundur railway station, 49°06'45"N, 130°43'48" E. Valley forest with *Tilia amurensis*, *Ulmus japonica* and *Pinus koraiensis*, 9-10.VI.2019.

Distribution. Russia (SE Amurskaya Oblast, S Khabarovsky Krai, Primorsky Krai), Korea, China.

Eudjakonovia emundata (Christoph, 1881)
Fig. 3.

Material examined. 1 ♂, Arkharinsky District, 5 km northeast of the Gribovka village, 49°31'53.7" N, 130°17'08" E. A northern exposure hillside covered with Quercus mongolica forest with *Larix gmelinii* and undergrowth of *Sorbaria sorbifolia*, *Acer tegmentosum*, 15.V.2019.

Distribution. Russia (SE Amurskaya Oblast, S Khabarovsky Krai, Primorsky Krai), Korea.

Menophra senilis (Butler, 1878)
Fig. 4.

Material examined. 1 ♀, Arkharinsky District, 4.5 km north-west of the Rachi railway station, 49°17'19" N, 130°24'42" E. *Quercus mongolica* forest with *Betula platyphylla*, with undergrowth of *Juglans mandshurica*, *Corylus sieboldiana*, *Eleutherococcus senticosus*, 09.VII.2020.

Distribution. Russia (SE Amurskaya Oblast, S Khabarovsky Krai, Primorsky Krai, S Sakhalin Island, Kunashir Island), Japan, Korea, China.

Ectropis excellens (Butler, 1884)
Fig. 5.

Material examined. 9 ♂♂, 2 ♀♀, Arkharinsky District, Khingan Nature Reserve, Karapcha cordon, 2 km west of Kundur railway station, 49°06'45"N, 130°43'48" E. Valley forest with *Tilia amurensis*, *Ulmus japonica*, and *Pinus koraiensis*, 9-10. VI.2019: 3 ♂♂, 1 ♀♀, Arkharinsky District, 4.5 km north-west of the Rachi railway station, 49°17'19" N, 130°24'42" E. Quercus mongolica forest with *Betula platyphylla*, with undergrowth of *Juglans mandshurica*, *Corylus sieboldiana*, *Eleutherococcus senticosus*, 14.VI.2021.

Note. The hind tibia of males of *E. excellens* are thickened and bear a brush of hair-like androconial scales (Fig. 5c), which is absent in the externally similar species *E. aigneri*.

Distribution. Russia (SE Amurskaya Oblast, S Khabarovsky Krai, Primorsky Krai, Sakhalin Island, Kunashir Island), Japan, Korea, China.

Ectropis aigneri Prout, 1930
Fig. 6.

Material examined. 3 ♂♂, 4 ♀♀, Arkharinsky District, Khingan Nature Reserve, Karapcha cordon, 2 km west of Kundur railway station, 49°06'45"N, 130°43'48"

E. Valley forest with *Tilia amurensis*, *Ulmus japonica* and *Pinus koraiensis*, 9-10. VI.2019.

Distribution. Russia (SE Amurskaya Oblast, S Khabarovsky Krai, Primorsky Krai), Japan, Korea.

Mesastrape fulguraria (Walker, 1860)
Fig. 7.

Material examined. 6 ♂♂, Arkharinsky District, Khingan Nature Reserve, Karapcha cordon, 2 km west of Kundur railway station, 49°06'45"N, 130°43'48" E. Valley forest with *Tilia amurensis*, *Ulmus japonica* and *Pinus koraiensis*, 9-10.VI.2019, 3 ♂♂, Arkharinsky District, 4.5 km north-west of the Rachi railway station, 49°17'19" N, 130°24'42" E. *Quercus mongolica* forest with Betula platyphylla, with an undergrowth of *Juglans mandshurica*, *Corylus sieboldiana*, *Eleutherococcus senticosus*, 3.VII.2021.

Distribution. Russia (SE Amurskaya Oblast, S Khabarovsky Krai, Primorsky Krai), Japan, Korea, China, Laos, Myanmar, Nepal, India.

Arichanna tetrica (Butler, 1878)
Fig. 8.

Material examined. 1 ♀, Arkharinsky District, Khingan Nature Reserve, Karapcha cordon, 2 km west of Kundur railway station, 49°06'45"N, 130°43'48" E. Valley forest with *Tilia amurensis*, *Ulmus japonica*, and *Pinus koraiensis*, 9-10.VI.2019.

Distribution. Russia (SE Amurskaya Oblast, S Primorsky Krai, S Sakhalin Island), Japan, Korea.

Agriopis dira (Butler, 1878)
Fig. 9.

Material examined. 5 ♂♂, Arkharinsky District, 4.5 km north-west of the Rachi railway station, 49°17'19" N, 130°24'42" E. *Quercus mongolica* forest with *Betula platyphylla*, with an undergrowth of *Juglans mandshurica*, *Corylus sieboldiana*, *Eleutherococcus senticosus*, 17. IV.2020; 2 ♂♂, Arkharinsky District, valley of the river Krivoy Domikan, 49°33'01.0"N 130°05'43.4"E. *Betula davurica* forest with *Quercus mongolica* and undergrowth of *Corylus heterophylla*, 22. IV.2021; 2 ♂♂, Arkharinsky District, valley of the river Krivoy Domikan, 49°33'01.0"N 130°05'43.4"E. *Betula davurica* forest with *Quercus mongolica* and undergrowth of *Corylus heterophylla*, 28.IV.2021.

Notes. Two forms were present in the material: more numerous dark (Fig. 9a) and the rarer light (Fig. 9b).

Distribution. Russia (SE Amurskaya Oblast, S Khabarovsky Krai, Primorsky Krai), Japan, Korea, China.

Figure 1. Map of the collection localities of Arkharinsky District of Amurskaya Oblast: 1 – valley of the river Krivoy Domikan, 2 – near Rachi railway station, 3 – near Gribovka village, 4 – near Tarmanchukan railway station, 5 – Khingan Nature Reserve, Karapcha cordon.

Larerannis orthogrammaria (Wehrli, 1927)
Fig. 10.

Material examined. 1 ♂, Arkharinsky District, 4.5 km north-west of the Rachi railway station, 49°17'19" N, 130°24'42" E. *Quercus mongolica* forest with *Betula platyphylla*, with an undergrowth of *Juglans mandshurica*, *Corylus sieboldiana*, *Eleutherococcus senticosus*, 6.X.2019.

Distribution. Russia (Moskovskaya Oblast (introduced), SE Amurskaya Oblast, S Khabarovsky Krai, Primorsky Krai), Japan, Korea, China (?).

Phigalia verecundaria (Leech, 1897)
Fig. 11.

Material examined. 1 ♂, Arkharinsky District, 7 km north of Tarmanchukan railway station, 49°14'14"N, 130°38'54" E. Mixed forest near the hill's top with *Tilia amurensis*, *Acer pictum*, and *Pinus koraiensis*, with *Eleutherococcus senticosus* and

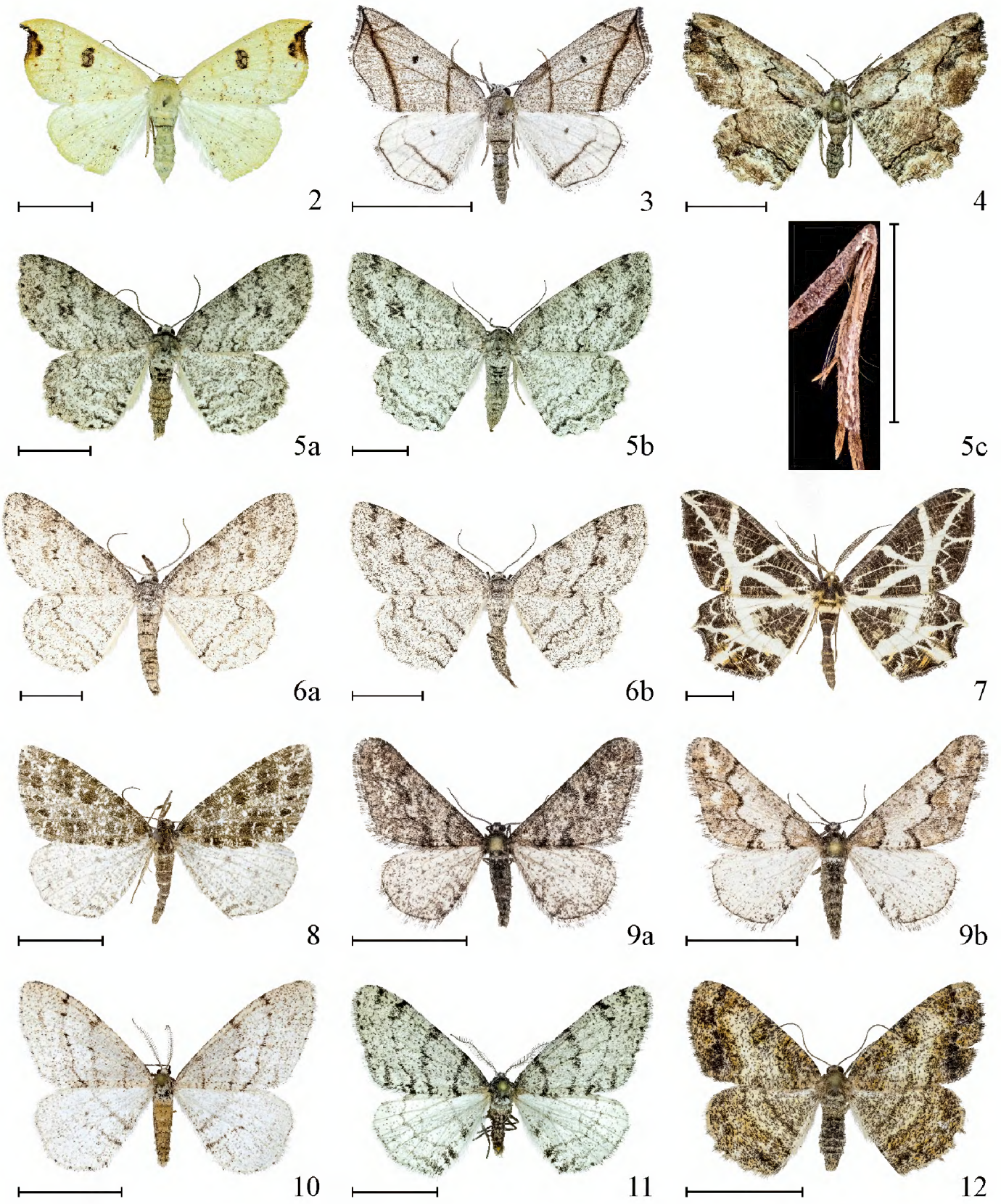

Figure 2-12. 2 – *Eilicrinia nuptaria*; 3 – *Eudjakonovia emundata*; 4 – *Menophra senilis*; 5 – *Ectropis excellens*: a –male, b – female, c – hind tibia of male with brush of hair like androconial scales; 6 – *Ectropis aigneri*: a – male, b – female; 7 – *Mesastrape fulguraria*; 8 – *Arichanna tetrica*; 9 – *Agriopis dira*: a – dark form, b – light form; 10 – *Larerannis orthogrammaria*; 11 – *Phigalia verecundaria*; 12 – *Phanerothyris sinearia*. Scale 10 mm, for figure 5c – 5 mm.

Actinidia kolomikta in the undergrowth, and with *Alnus hirsuta* at the forest edge, 10.IV.2020, ♂, Rachi, 17.04.2020; 2 ♂♂, Arkharinsky District, valley of the river Krivoy Domikan, 49°33'01.0"N 130°05'43.4"E. *Betula davurica* forest with *Quercus mongolica* and undergrowth of *Corylus heterophylla*, 22. IV.2021; 1 ♂, Arkharinsky District, valley of the river Krivoy Domikan, 49°33'01.0"N 130°05'43.4"E. *Betula davurica* forest with *Quercus mongolica* and undergrowth of *Corylus heterophylla*, 28.IV.2021.

Distribution. Russia (SE Amurskaya Oblast, S Khabarovsky Krai, Primorsky Krai), Japan, Korea.

Phanerothyris sinearia (Guenée, 1858)
Fig. 12.

Material examined. 1 ♀, Arkharinsky District, 4.5 km north-west of the Rachi railway station, 49°17'19" N, 130°24'42" E. *Quercus mongolica* forest with *Betula platyphylla*, with undergrowth of *Juglans mandshurica*, *Corylus sieboldiana*, *Eleutherococcus senticosus*, 13.VII.2020.

Distribution. Russia (SE Amurskaya Oblast, S Khabarovsky Krai, Primorsky Krai), Japan, Korea, China, Vietnam.

Discussion

Considering the latest findings, the total number of geometrid moths listed for the Amurskaya Oblast reaches 401 species. This amount is intermediate between the diversity of the family in the meridionally neighboring regions – Zabaikalsky Krai on the west (302 species) and Khabarovsky Krai on the east (483 species). Since the fauna of geometrids in Amurskaya Oblast is still insufficiently studied, especially in the north and northwest, and, in part, in the southeast, we should expect its species composition to be replenished, both by boreal Siberian and nemoral East Asian species.

Based on the distribution of the listed species, zoogeographically, all of them are representatives of the East Asian nemoral fauna. This is due to the research being carried out in the area of the northwestern border of the mixed broadleaved – Korean pine forests. The new data significantly advance the ranges of these species to the northwest, up to 100 – 400 km from their previously known habitats in Khabarovsky Krai and the Jewish Autonomous Oblast. Of particular interest is the discovery of *A. tetrica*, which nearest habitats are still known only from the south of Primorsky Krai, at a distance of about 600 km south of the new locality of the species in Amurskaya Oblast. Such finds seem to be related to the current climate warming trend. However, they are most likely a result of insufficient knowledge of geometrid moths in the Amur region.

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